

PROCESS
CONTROL
SYSTEM

PREKORDER
MODELS
5052S, 5052C

the NEW PREKORDER

PROGRAMS

...from a plotted program curve

CONTROLS

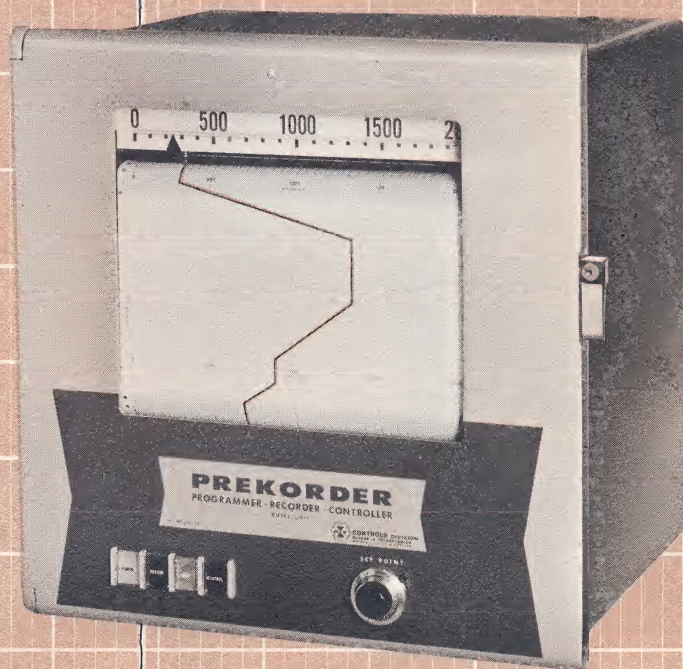
...temperature, position, pressure, power, etc.

RECORDS

...actual process performance directly over the program curve



PREKORDER
Model 5052C



PREKORDER
Model 5052S

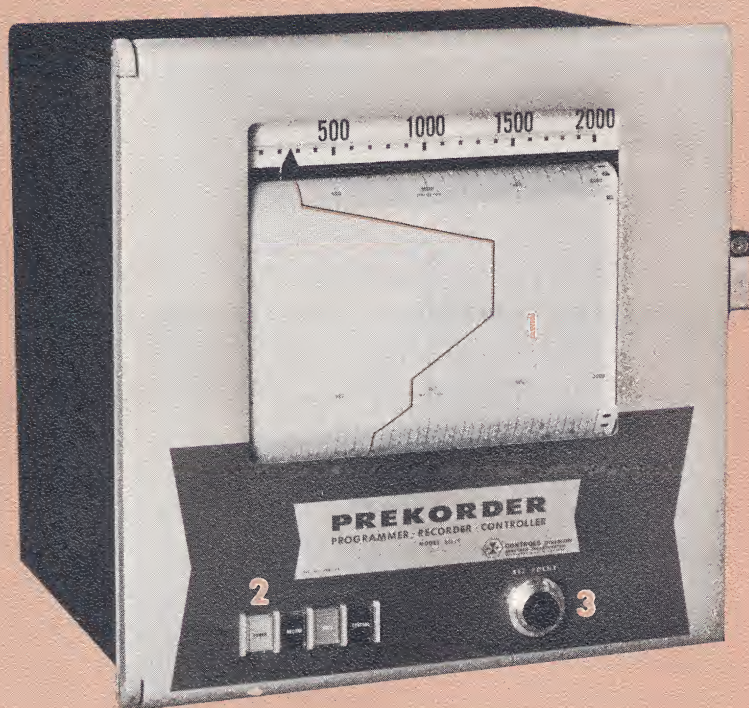


R·I CONTROLS

A DIVISION OF RESEARCH, INCORPORATED
P.O. BOX 6164, MINNEAPOLIS, MINNESOTA 55424

Specialists in:
HIGH - PERFORMANCE PROGRAMMING AND CONTROL •
INFRARED HEATING • AC AND DC POWER CONTROLLERS

PREKORDER ... a unique concept in automatic control



PREKORDER not only combines the functions of *programming, controlling and recording* in a single instrument, but it also performs them in a *single closed-loop control system*.

What it is — PREKORDER is a high quality null-balance recorder-controller which has an automatically variable control reference produced by drawing a program line on metallized chart paper. Its recording pen serves two functions. One function is to ink a permanent record of process variations. In its second function, the pen is a capacitive probe which picks up a signal proportional to pen deviations from the plotted program. This signal is amplified in the three-mode controller section of the PREKORDER to provide a corrective output usable by most process control devices.

- 1 RECORDING CHART overlays program chart which is visible through it.
- 2 RUN CONTROLS
- 3 SET-POINT CONTROL

- 4 RECORDER ELECTRONIC UNIT
- 5 SWING-OUT CHART DRIVE AND RECORDING MECHANISM
- 6 RECORDING CHART in front, PROGRAM CHART behind
- 7 PROGRAMMER/CONTROLLER ELECTRONIC UNIT

PREKORDER FEATURES

EASY TO PREPARE PROGRAMS—The program chart is drawn on metallized paper with ordinary drafting tools.

EASY TO MONITOR—Recording takes place on a translucent chart directly overlaying the program chart thereby enabling continuous visual comparison of actual performance with the program line.

RESET may be introduced to correct for control droop.

PROPORTIONAL BAND IS PROGRAMMABLE by varying width of program line.

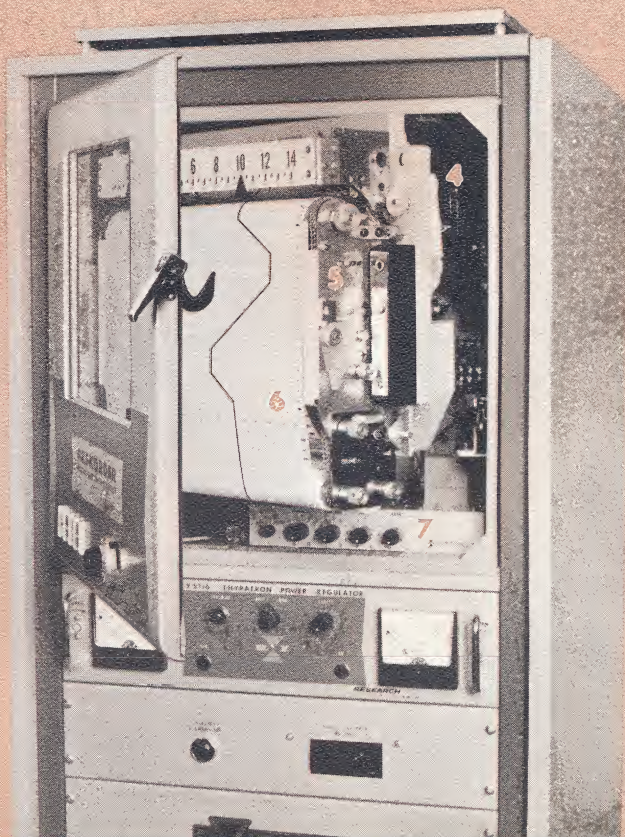
LIMITS ARE EASILY PROGRAMMABLE by merely drawing pencil lines on recording chart.

EXTREME ACCURACY is attained by closed-loop control. Instrument errors are eliminated by continuous electronic comparison of actual recorded value with desired plotted value.

PREKORDER IS RUGGEDLY BUILT to withstand conditions of industrial plant installation. Control circuitry is *solid state*.

USABLE AS A RECORDER ONLY—PREKORDER operates like any standard potentiometric recorder when programming is not wanted. In this mode of operation, the controller output may be manually adjusted if desired.

USABLE AS A SET-POINT CONTROLLER—PREKORDER may also be used as a set point controller with or without the recording function. Set point is adjustable externally.



SO EASY TO USE . . .

Preparing the program

PREKORDER programming is easily accomplished by simply "drawing" the program with a heated stylus on a metallized paper chart. The stylus effectively demetallizes the paper in a narrow line, thus separating the chart into two metallized (conductive) areas. Ordinary drafting tools may be used to guide the stylus, and no special skills are required. There are no limitations on the steepness of the curve, and you can even program the "tightness" of control by simply varying the program line width.

Installing the charts

The PREKORDER chart carriage swings out of the case for easy access. The program chart (in the form of a closed belt or a non-repeating strip chart) is first placed over a platen. Then a second translucent paper recording chart is placed over the program chart, allowing direct visual comparison of actual process performance.

Operation

PREKORDER operation is controlled by four push-buttons on the door front and five adjustment knobs on the subpanel inside.

The POWER button energizes the equipment and sets the instrument in operation as an indicator only; the RECORD button drops the recording pen onto the paper; the CONTROL button brings the program control function into play, and the HOLD button stops the chart drive while maintaining process control.

A MODE SELECTOR switch inside the instrument gives the operator a choice of three control references: (1) program chart, (2) set-point dial, or (3) manual adjustment knob. In the *set-point* mode, the system maintains a selected process operation level (such as temperature). In the *manual* mode, PREKORDER output can be adjusted through its full range.

Other adjustment knobs *limit* the PREKORDER's maximum output signal, adjust the *system gain*, and adjust the amount of *reset* introduced.

Separate high and low operational limits are easily set by placing the translucent recording chart over the program chart and drawing pencil lines on the recording chart in relation to the program line. If either of the limit lines is contacted by the recording pen, an alarm or shutdown relay is actuated.



TYPICAL APPLICATIONS

PROGRAMMING, CONTROLLING, RECORDING

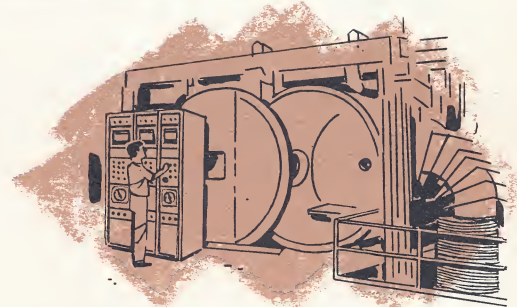


LABORATORY OVENS

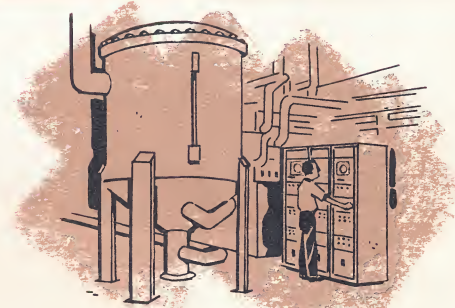


ENVIRONMENTAL CHAMBERS

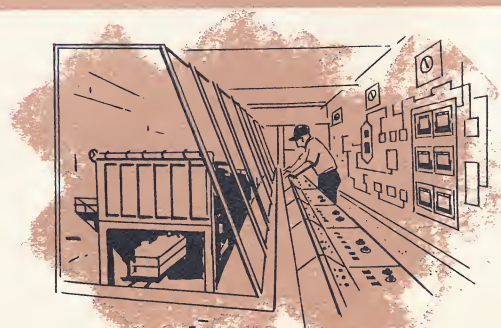
SEE SPECIFICATIONS UNDER THIS FLAP



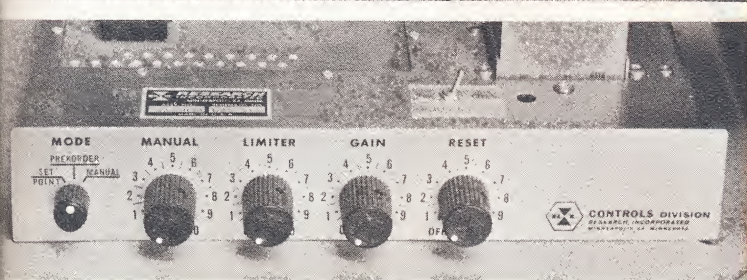
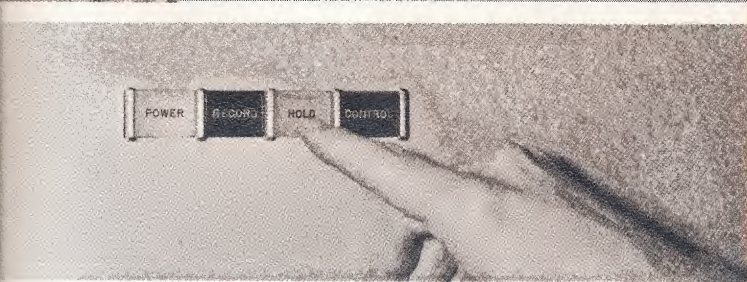
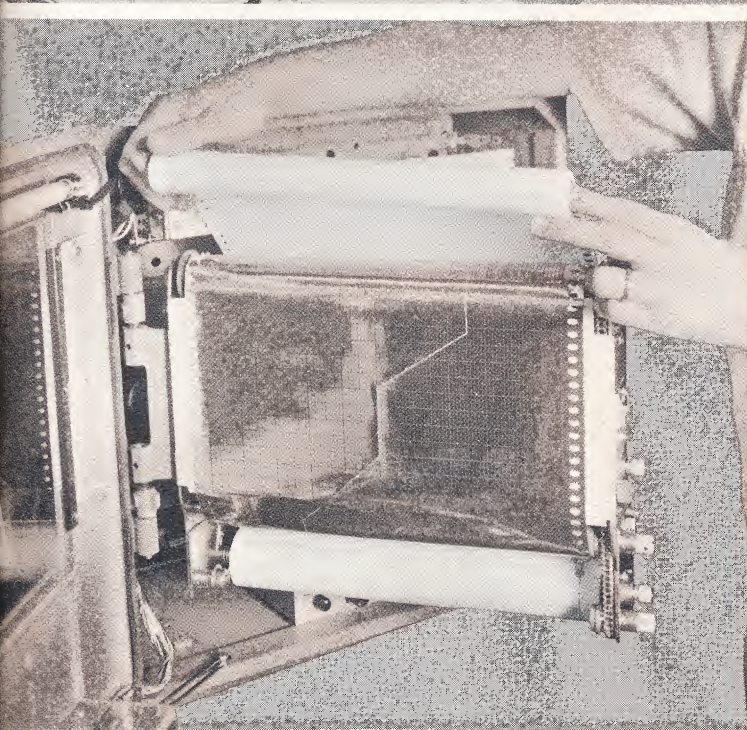
AUTOCLAVES



CHEMICAL PROCESSES



INDUSTRIAL HEATING



SPECIFICATIONS

TYPES AVAILABLE—Both round-chart model 5052C and strip-chart model 5052S are available with potentiometric or bridge-type servo measuring circuits.

TEMPERATURE RANGES—Over 100 standard ranges available. Others obtainable by special order.

CHART AND INDICATOR SCALES—A wide range of scales is available for nearly any requirement.

DIMENSIONS—All models fit standard rack openings.

Prekorder case: 18½" wide, 18½" high, 19½" deep.

Door: 19" wide, 19½" high, 7⅞" deep.

CHART SPEED—Determined by chart motor and interchangeable gears. Standard strip chart speeds range from ¾" per hour to 120" per minute. Round chart rotation is measured in minutes, hours, or days as determined by motor selection.

PEN SPEED—Choice of speeds from 12 sec to 0.4 sec, full scale balance-to-balance.

OUTPUT—An electrical signal proportional to recording pen displacement from the center of program line. Three tap terminals are provided to enable selection of output, impedance and signal range as follows:

(1) *Low impedance signal*: -1.2 to +1.2 ma into 200-ohm load.

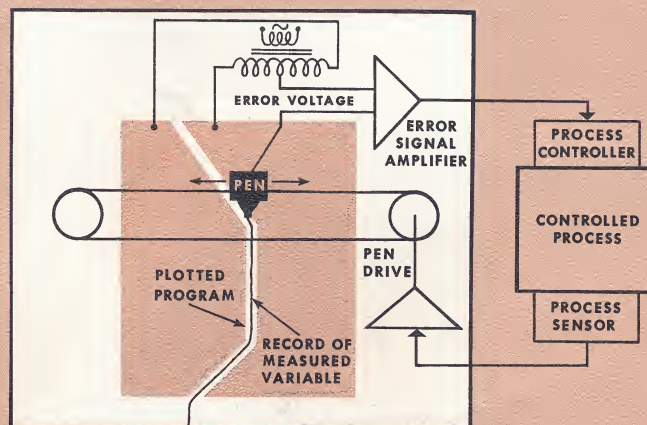
(2) *Medium impedance signal*: -1.0 to +3.3 ma into 1500 ohms.

(3) *High impedance signal*: 0 to 5 ma into 4000 ohms.

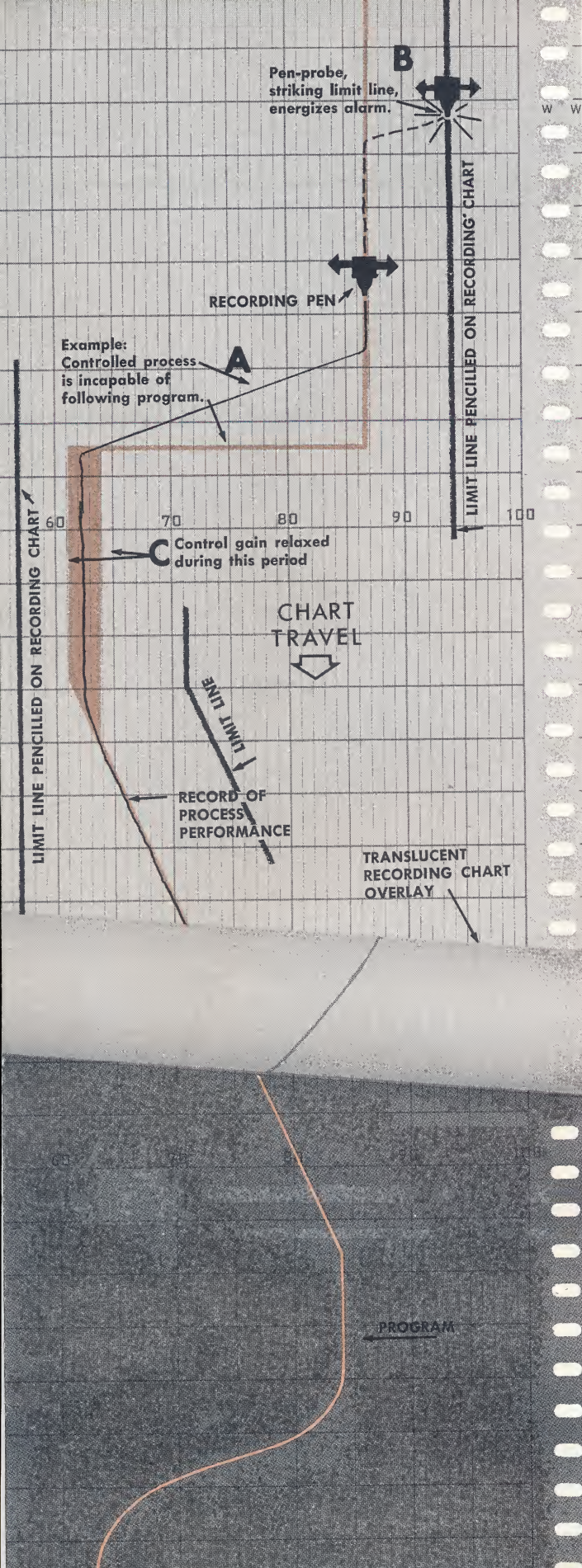
In all ranges, zero signal occurs when pen is centered over program line.

(Other output ranges available by special order)

SCHEMATIC



This schematic diagram traces the complete control loop from plotted program line to the recording pen. Note that the metallized program chart is divided by the program line into two halves which become two plates of a capacitor when connected across a transformer winding as shown. The recording pen is also a capacitive probe whose potential is compared by a signal amplifier with that of the transformer center tap. Thus, any deviation of the recording pen from the exact center of the program line results in a corrective command signal to the process control equipment. The resulting change in the process variable is measured by a sensor and recorded, causing the recorder pen to move back toward the center of the program line.



HOW PREKORDER WORKS

PREKORDER uses two separate charts—one with a metallized surface on which the program is drawn, and the other a translucent vellum paper on which the PREKORDER records process performance. The two charts are transported under the recording pen by the chart drive mechanism. (In the Model 5052S Strip-chart PREKORDER separate supply and take-up reels are provided.)

The illustration at left shows the two charts superimposed. Notice how the program line is continuously visible through the recording chart paper for easy monitoring of the process operation.

Under normal operation, with PREKORDER programming a process, the recording pen trace will split the program line down the middle as shown in the lower portion of the illustration. However, two instances are shown in which the recording may not follow the program. The first of these is at "A" where the program jogs too abruptly for the process machinery to keep up. Here the process is under full control and the recording pen traces its approach to the higher programmed value.

The second instance is shown at "B" where an equipment malfunction has occurred, causing the process to go out of control. The recording pen, tracing the resulting uncontrolled rise in the process variable (temperature, for example) contacts a *limit line* drawn with ordinary pencil on the recording chart. This contact effectively increases the area of the probe and thereby increases the capacitance between the pen and the metallized program chart paper. The resulting boost in error signal triggers an alarm relay. Separate relays are provided for high and low limit lines.

At "C" the program line is broadened out to produce a wider proportional band in that portion of the program.

Since the PREKORDER controlling-recording system is a single closed loop which includes the controlled process itself as well as the actual program chart and recording pen, accuracy is limited only by the ability of the controlled process machinery to follow the program and by the accuracy of the recording pen positioning mechanism (nominally $\frac{1}{4}\%$).

RELATED R-I EQUIPMENT

POWER REGULATORS—Ignitron, Thyatron and Solid-State Power Regulators. (Request Bulletin 503.2)

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RESISTANCE HEATING SYSTEMS—Step-down Transformers for direct heating and brazing. (Request Bulletin 505)

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